

RANGE-WIDE SURVEY AND ESTIMATION OF TOTAL NUMBER OF STELLER SEA LIONS IN 1989

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ABSTRACT

The first range-wide survey of Steller (northern) sea lions (*Eumetopias jubatus*) was completed in 1989 with a total of 68,094 adult and juvenile (nonpup) Steller sea lions counted. This total count includes 10,000 in Russia (15% of the range-wide count), 47,960 in Alaska (70%), 6,109 in British Columbia (9%), 2,261 in Oregon (3%), and 1,764 in California (3%). A range-wide pup count was not obtained. We estimated the 1989 world population based on a calculation for total pups and obtained a range-wide estimate of 116,000 total animals, or about 39-48% of the 240,000-300,000 estimated 30 yr ago.

Key words: Steller sea lion, northern sea lion, *Eumetopias jubatus*, range-wide survey, population size.

The numbers of Steller (northern) sea lions, *Eumetopias jubatus*, have declined throughout most of Alaska (Merrick *et al.* 1987, Loughlin *et al.* 1990), resulting in the species being listed as threatened on 26 November 1990 under the U.S. Endangered Species Act. The causes of the decline are unknown, but they may be linked to redistribution, disease, environmental perturbations (which may influence the quality and quantity of prey), the synergistic effects of fisheries (including the indirect effect of reducing prey availability), or other causes (Braham *et al.* 1980, Merrick *et al.* 1987, Loughlin and Merrick 1989, Lowry *et al.* 1989).

Kenyon and Rice (1961) summarized the distribution and numbers of Steller sea lions in the late 1950s and early 1960s and estimated between 240,000 and 300,000 sea lions throughout the range. Their counts were obtained during different years and prior to the breeding season; their total estimate included counts from photographs and an estimate of animals missed during surveys. Loughlin *et al.* (1984) estimated range-wide numbers of about 245,000 to 290,000, but noted continued declines in numbers in the eastern Aleutian Islands as first reported by Braham *et al.* (1980). Since those reports, the species declined in numbers in most of Alaska (Merrick *et al.* 1987), the Kuril Islands (Perlov 1970), and California. No recent changes in numbers were reported for British Columbia (Bigg 1985).

Our report describes the results of the first range-wide survey of Steller sea lions conducted during a single year, and summarizes both published and unpublished information for 1989. The survey was conducted to determine the role that emmigration into Soviet waters may have contributed to observed declines in Alaska.

METHODS

Steller sea lions were counted on rookery and haul-out sites throughout the species' range during the breeding period in June and July 1989. The optimal counting period at rookeries and haul-out sites is when most animals are on land from mid-June to the first week of July, and from about 1000 to 1600 hr (Withrow 1982); the breeding season is synchronized throughout the range (Bigg 1985: fig. 2) and occurs from late May to early July, but peaks from mid-June to early July (Pitcher and Calkins 1981). In most cases animals were counted during the optimal counting period using different methods in different parts of the range depending on what was most practical for a given area. The reader should keep in mind that counts of adults and juveniles (nonpups) were made only once at a given location; estimates of the variability in counts of animals caused by weather, disturbance, and other factors are not available. Pup counts were obtained from land either from a clear vantage point or by slowly walking through the rookery after nonpups were herded off the rookery. Pup counts are generally considered more accurate than aerial surveys of nonpups.

In the Kuril Islands, adults, juveniles, and pups were counted from small boats (adults and juveniles) less than 500 m off shore or from land (pups) while slowly walking through the rookery. In the Okhotsk Sea, adults, juveniles, and pups were counted from land at vantage points above the sea lions. In Kamchatka, adults and juveniles were counted from photographs obtained during aerial surveys flown at approximately 200 m altitude, air speed at about 90 knots, and approximately 500 m offshore; pups were not counted. On the Commander Islands, adult, juvenile, and pup counts were obtained on land from vantage points above the rookeries.

In the Near Islands (western Aleutian Islands), nonpups and pups were counted from vantage points above the rookeries and haul-out sites. In the remainder of the Aleutian Islands, Gulf of Alaska, and southeast Alaska, adults

and juveniles were counted from photographs obtained during aerial surveys (Loughlin *et al.* 1990); pups were counted at three Aleutian Island rookeries (Merrick *et al.* 1990) and several rookeries in the remainder of Alaska by herding all nonpups into the water and then walking through the rookery to count pups. All counts in Oregon were from photographs taken during aerial surveys. Counts in California were a mix of land, small boat, and aerial surveys, depending on the location. There were no counts in Washington because there are no rookeries there and the number of animals believed to occur there during the breeding season was less than 500; peak counts of about 1,500 Steller sea lions occur during fall and winter as animals move through the area from rookeries to the north and south.

Counts in British Columbia were conducted by aerial survey at the three rookeries in the Scott Islands. Counts from 1987 for the rookeries and haul-out sites not surveyed in 1989 were included with the 1989 rookery count.

There have been no studies to develop biological criteria for separating Steller sea lions in different geographic regions into separate populations. Thus, our presentation is divided on the basis of convenient geographic regions rather than biological criteria.

RESULTS

Russia

An estimated 41,000–52,300 Steller sea lions inhabited the waters of Russia in the mid-1960s (Perlov 1982). About 29–49% of the population was on the Kuril Islands, with Kamchatka, the Commander Islands and the other sites comprising a decreasing percentage of the total (Table 1).

Kuril Islands—The Kuril Islands support the largest group of Steller sea lions in Russia and are the reproductive center of the species in Soviet waters; these islands include the primary rookeries where 98% of all pupping takes place (Perlov 1982). Counts in 1989 resulted in 3,615 adults and juveniles and 1,479 pups (Merrick *et al.* 1990) (Table 2). Srednego Island and Lovushki Island are the largest rookeries and account for 433 and 381, respectively, of the 1,479 pups counted (Table 2; Fig. 1). From 1955 to 1968 the Steller sea lion population in this area was stable at about 15,000–20,000 individuals. The population has declined steadily since the late 1960s to 1989 (Fig. 2). The Kuril Island population is currently stable at low levels.

Okhotsk Sea—Steller sea lion rookeries occur at Iony Island and Iamskiy Island in the western Okhotsk Sea; haul-out sites exist at Robben (Tyuleniy) Island and at Opasnostiy Rock in LaPerouse Strait (Fig. 1). The number of sea lions at these sites has always been low.

The 1989 estimate at Iony Island was 1,500 animals, of which 462 were pups. During the 1930s the adult population there ranged between 5,000 and 6,000 animals (Nikulin 1937); in 1974, Perlov (1977) estimated 1,200 animals. The reduction in numbers from the 1930s to 1989 is attributed to the

Table 1. Counts of Steller sea lions in Russia during 1988–1989 compared to counts prior to the decline in numbers.

Location	1988–1989		Counts prior to the decline	
	Num-ber	Source	Number	Source
Kamchatka	3,082	Burkanov pers. comm.	8,700–12,000 (1982–1984)	Burkanov <i>et al.</i> 1988
Kuril Islands	3,615	Merrick <i>et al.</i> 1990	15,000–20,000 (1955–1968)	Klumov 1957 Belkin 1966 Perlov 1970
Commander Islands	890	Burkanov pers. comm.	4,000 (1952–1957)	Khromovskich 1966
Iony Island	1,038	TINRO data	5,000–6,000 1,200 (1974)	Nikulin 1937 Perlov 1977
Iamskiy Island	875	Sayakhova pers. comm.	1,200 (1930s) 800 (1974)	Nikulin 1937 Perlov 1977
Tyuleni Island	200	TINRO data	200	TINRO archival data
Opasnostiy Rock	300	R. N. Lakeev, Sakhalinrybvod inspector	300	R. N. Lakeev, Sakhalinrybvod inspector
Total	10,000		30,200–43,700 ^a	

^a This total is less than the 41,000–52,300 mentioned in the text because it includes counts obtained after the mid-1960s reported in Perlov (1982).

Table 2. Mean counts of Steller sea lions on rookeries (*) and haul-out sites in the Kuril Islands by site and sex-age category during 1989 (from Merrick *et al.* 1990).

Location	Date	Survey type ^a	Adult male	Other adult and juvenile	Pups	
					Alive	Dead
Lovushki*	19 June	S	190	570	372	9
Raykoke*	21 June	S	77	189	157	5
Srednego*	22 June	S	111	455	426	7
Chernyye*						
Brat'ya	24 June	S/B	103	482	267	9
Iturup	28 June	B	7	115	0	0
Simushir	2 July	B	14	96	1	0
Ketoy	3–4 July	B	14	202	2	0
Shiashkotan	7 July	S/B	21	300	0	0
Antsiferova*	10 July	S/B	89	453	220	4
Avos Rock	10 July	B	9	0	0	0
Onekoton	11 July	B	11	10	0	0
Atlasova	11 July	B	10	87	0	0
Total			656	2,959	1,445	34

^a S = Spook or cliff count; B = Boat count.

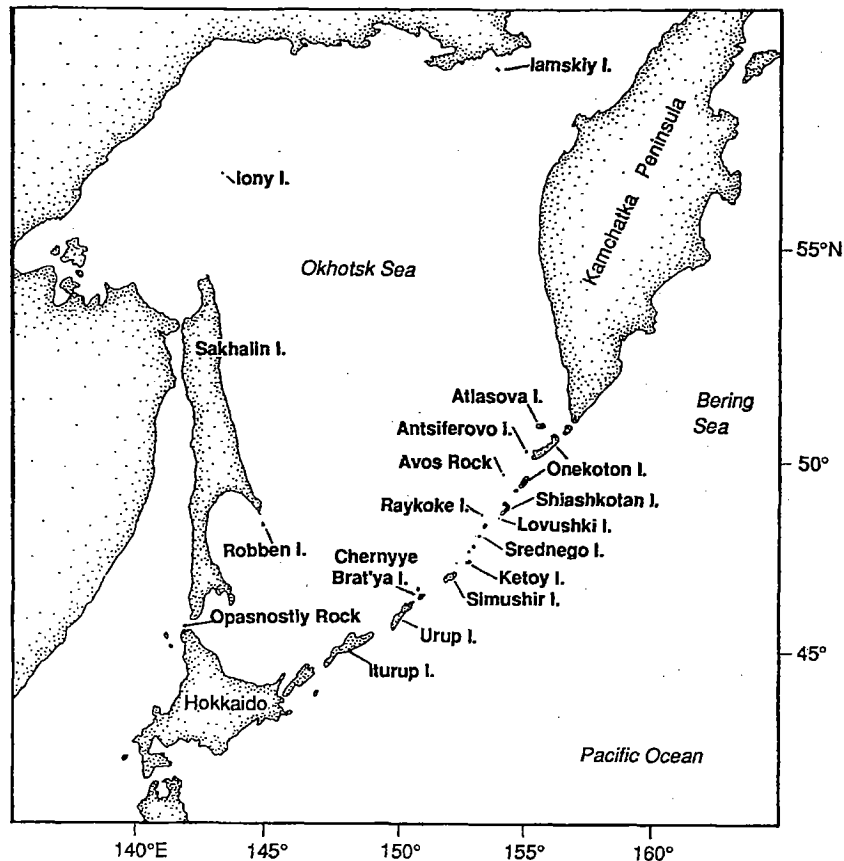


Figure 1. Map depicting Steller sea lion rookeries and haul-out sites in the Okhotsk Sea and Kuril Islands, Russia.

extensive harvest of pups during the 1930s and 1940s (Perlov 1991); the population has not recovered since the cessation of the pup harvest.

Historically the number of animals at Iamskiy Island was about 1,200 individuals (Nikulin 1937). In 1988, 875 adults were counted along with 230–270 pups. No survey was conducted in 1989.

Small numbers of sea lions haul out near the northern fur seal (*Callorhinus ursinus*) rookeries at Robben (Tyuleniy) Island. In 1989, 200 sea lions were counted along with 35 pups. Opasnostiy Rock in LaPerouse Strait is not a large haul-out site, but in July 1991 nearly 300 individuals occurred there.

Kamchatka—Steller sea lions occur at 23 locations along the Kamchatka Peninsula (Fig. 3). In 1989, 3,082 adults and juveniles were counted at these sites during aerial surveys from 20 June to 5 July (Table 3). Pups were not counted, but rookeries probably occur at Shipunskiy Cape, Zheleznaya Bay, Kozlova Cape, Kamchatskiy Cape, Krashennnikova Cape, Verkhoturva Island,

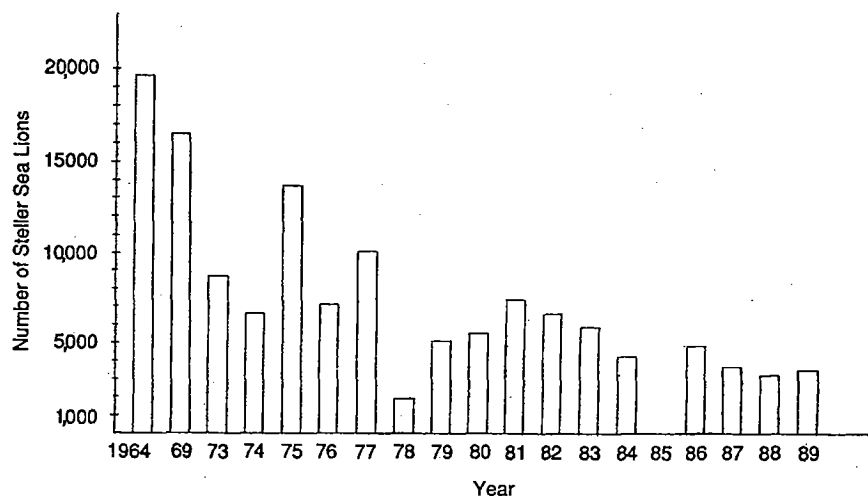


Figure 2. Number of Steller sea lions in the Kuril Islands, 1964–1989. Does not include pups. (From Perlov 1991.)

and Vitgenshteyn Cape. Estimates from 1982 to 1984 range from 8,700 to 12,000 animals during spring.

Commander Islands—Historically, Steller sea lions have occurred at ten sites on the Commander Islands, but only four sites are used presently, excluding the one male seen at Ariy Rock (Fig. 3, Table 3). From 1941 to 1945, and again from 1952 to 1957, counts reached 4,000 individuals with breeding occurring at some sites (Khromovskich 1966). The population has since declined in numbers. In 1989, 890 sea lions older than 1 year of age and 185 pups were counted (Table 3).

United States

The overall breeding range of Steller sea lions in the United States occurs in Alaska from the Pribilof Islands in the Bering Sea, through the Aleutian Islands, the Gulf of Alaska, and southeastern Alaska, south into Oregon and California (Loughlin *et al.* 1984). No rookeries occur in Washington state. Seal Rocks in Prince William Sound, Alaska, represents the northernmost rookery for the species, and Año Nuevo Island in central California represents the southernmost rookery.

Alaska—Adult and juvenile counts for the state in 1989 totaled 47,960 individuals, down from a partial count in 1985 of 78,709 individuals (Merrick *et al.* 1987).

At Walrus Island (Pribilof Islands), a pup count was made in August 1989, past the optimal survey period. The count of 225 adults and juveniles and 250 pups was dramatically lower than the 3,000 pups born there in 1960.

Counts in the Western Aleutian Islands (Near Islands and Buldir Island, Fig. 4) in 1989 totaled 3,525 adults and juveniles (Table 4), an increase from 3,130

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Table 3. Number of Steller sea lions on rookeries (*) and haul-out sites in Kamchatka and the Commander Islands during June-July 1989 (V. Burkanov, personal communication).

No.	Location	Date	Number		Total	Method
			Males ^a	Other nonpups		
			Kamchatka			
1	Sivuchiy Cape	5 July	2	2	4	visual
2	Gavryushkin Rock	5 July	0	0	0	visual
3	Krestoviy Cape	5 July	0	0	0	visual
4	Sivuchiy Rock	5 July	0	0	0	visual
5	Kekurniy Cape*	5 July	7	119	126	photo
6	Bezimyaniy Reef	5 July	0	0	0	photo
7	Chalakitirskiy Pillar	19 June	8	28	36	photo and visual
8	Shipunskiy Cape*	19 June	19	166	185	photo
9	Zheleznaya Bay	22 June	16	27	43	visual
10	Kozlova Cape*	22 June	80	471	551	photo
11	Kronotskiy Cape	22 June	no data; in water		23	visual
12	Kamchatskiy Cape*	22 June	34	541	575	photo
13	Afrika Cape	22 June	0	0	0	photo
14	Sivuchiy Cape ^b	20 June	1	2	3	visual
15	Krashennikova Cape*	23 June	5	382	387	photo
16	Urie Cape	23 June	1	4	5	visual
17	Verhoturova Island*	21 June	10	400	410	visual
18	Govena Cape	21 June	1	8	9	visual
19	Irene Cape	not surveyed				
20	Stupenchatiy Cape	19 June	nd	nd	225	visual
21	Tirmniy Cape	not surveyed				
22	Vignshteyn Cape*	22 June	nd	nd	500	photo and visual
23	Dryaviy Cape	not surveyed				
	Subtotal				3,082	

Table 3. Continued.

No.	Location	Date	Number			Total	Method
			Males ^a	Other nonpups			
Commander Islands							
24	Airy Rock	29 June	1	0		1	visual
25	Bering Island						
25	Northwest Cape	14 July	3	33		36	visual
26	Iushina Cape	14 July	2	16		18	visual
27	Manaiti Cape*	13 July	32	378		410	visual
					(+8 pups)		
28	Gladkovskaya Bay	13 July	0	0		0	visual
	Medny Island						
29	Southeastern Cape*	2 July	68	358		426	visual
						(+177 pups)	
30	Krasnaya Bay	3 July	0	0		0	visual
	Subtotal					891	
	Total					3,973	

^a Adult males.

^b Two sites have the same name.

nd = no data.

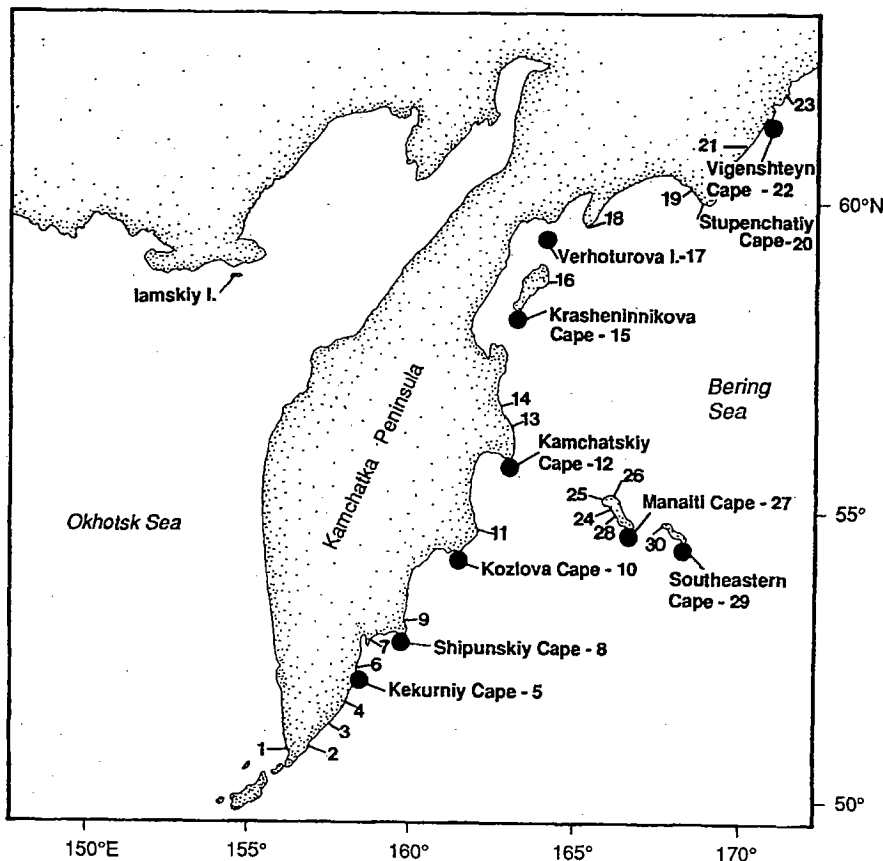


Figure 3. Map depicting Steller sea lion rookeries and haul-out sites in the Commander Islands and Kamchatka Peninsula, Russia. Refer to Table 2 for names associated with reference numbers.

individuals counted in 1985. Pup counts at Buldir Island and Agattu Island were 463 and 1,153, respectively. The rookery at Cape Wrangell, Attu Island (1,306 adults and juveniles in 1987), and the haul-out sites at Alaid and Shemya (1,223 individuals, combined, in 1986) were not surveyed in 1989.

Adult and juvenile counts in the central Aleutian Islands (Rat Islands and Andreanof Islands) totaled 7,602 individuals (Table 4), down from 25,759 counted in 1985. Pups were counted at Kiska (559 pups) and Seguam Islands (556 pups) in 1989, down from 882, and 2,635 pups counted in 1985 (Merrick *et al.* 1987).

In the eastern Aleutian Islands (Islands of Four Mountains and Fox Islands), the adult and juvenile count was 3,173, down from the 10,611 counted in 1985 (Table 4). Pups were counted only at Bogoslof Island (381 pups) and Ugamak Island (434 pups) in 1989, down from 1,109 and 1,635 pups counted in 1985 (Merrick *et al.* 1987).

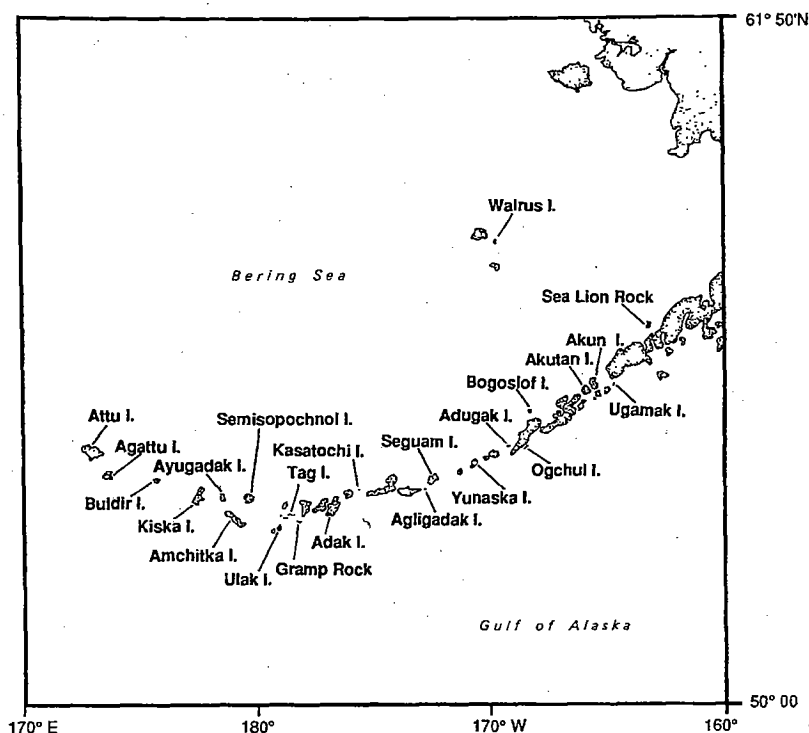


Figure 4. Map depicting Steller sea lion rookeries in the Aleutian Islands and Bering Sea, Alaska (modified from Merrick *et al.* 1987).

Nonpup counts in the Gulf of Alaska for 1989 totaled 23,749 (Table 4). Only part of the Gulf was surveyed in 1985, and comparison of those counts (31,247 individuals) with the same sites in 1989 (15,737 individuals) shows a 50% decline in abundance in 4 years (Loughlin *et al.* 1990).

Adult and juvenile counts in southeast Alaska in 1989 totaled 9,244 (Table 4), up from 7,962 counted in 1985. Pups were counted at Forrester Island (2,844 pups; Fig. 5). Southeastern Alaska is the only area in the state where sea lion numbers are not declining.

Washington—No counts were conducted in Washington, but we list in Table 5 the haul-out sites and range of counts during August to March over the past 15 years for reference.

Oregon—The total count for Oregon was 2,261 adults and juveniles on 22 June (Table 6) and 593 pups on 6 July. The principal rookeries (Fig. 6) were at Rogue Reef (407 pups) and Orford Reef (181 pups), with minor pup production at Three Arch Rocks (5 pups). The nonpup count at Orford Reef was lower than in previous years, perhaps due to changes in sea lion haul-out behavior caused by disturbance from commercial fishing vessels. However, the population in Oregon has remained stable since about 1975 at about 2,500

Table 4. Counts of adult and juvenile Steller sea lions at rookeries (*) and major haul-out sites in Alaska during 1989 (from Loughlin *et al.* 1990, D. G. Calkins and G. V. Byrd, personal communication).

Location	Date	Count
Bering Sea		
Walrus Island*	mid August	225
Sea Lion Rock*	15 June	344
Amak Island	15 June	98
Subtotal		667
Near Islands		
Attu Island*	No survey	
Agattu Island*	29 June	2,486
Buldir Island*	29 June	1,039
Alaid Island	No survey	
Shemya Island	No survey	
Subtotal		3,525
Central Aleutian Islands		
Kiska Island*	20 June	1,026
Tanadak Island	20 June	136
Ayugadak Island*	20 June	389
Amchitka Island*	missed because of high winds	
Semisopochnoi Island*	missed because of high winds	
Ulak Island*	20 June	1,123
Unalga Island	20 June	178
Tag Island*	20 June	590
Gramp Rock*	20 June	747
Adak Island*	29 June	424
Little Tanaga Island	18 June	150
Great Sitkin	missed because of high winds	
Kasatochi Island*	17 June	659
Atka Island	17 June	333
Sagigik Island	17 June	116
Tanadak Island	17 June	84
Agligadak Island*	17 June	132
Seguam Island*	17 June	709
Yunaska Island*	17 June	466
Assorted small sites		340
Subtotal		7,602
Eastern Aleutian Islands		
Chuginadak Island	16 June	248
Adugak Island*	16 June	392
Ogchul Island*	16 June	217
Cape Aslik	16 June	98
Bogoslof Island*	16 June	682
Akutan Island*	15 June	578
Akun Island*	15 June	150
Ugamak Island*	15 June	450
Assorted small sites		358
Subtotal		3,173

Table 4. Continued.

Location	Date	Count
Gulf of Alaska		
Lighthouse Rocks	14 June	172
Spitz Island	14 June	156
Whaleback	15 June	355
Jude Island	missed because of fog	
South Rock	missed because of fog	
Clubbing Rocks*	15 June	856
Pinnacle Rock*	15 June	1,366
Sea Lion Rocks	15 June	96
Chernabura Island*	15 June	544
Atkins Island*	15 June	755
Castle Rock	15 June	79
Chirikof Island*	14 June	1,278
Chowier Island*	14 June	737
Nagai Rocks	14 June	233
Surwik Island	14 June	210
Ugaiushak Island	14 June	138
Puale Bay	13 June	309
Cape Sirkinak	14 June	204
Twoheaded Island	14 June	479
Marmot Island*	14 June	2,331
Sea Otter Rocks	14 June	450
Latax Rocks	14 June	354
Sugarloaf Island*	17 June	2,467
Ushagar Island	17 June	245
Cape Elizabeth	13 June	249
Perl Island	17 June	159
Gore Point	17 June	76
Outer Island*	17 June	1,127
Chiswell Islands	17 June	456
Rugged Island	17 June	190
Point Elrington	17 June	487
The Needle	18 June	668
Wooded (Fish) Island	18 June	1,333
Seal Rocks*	18 June	2,159
Cape St. Elias	17 June	1,883
Venisa Point	17 June	533
Assorted small sites		615
Subtotal		23,749
Southeastern Alaska		
White Sisters*	20 June	734
Cape Ommaney	22 June	363
Hazy Island*	22 June	1,462
Timbered Island	22 June	385
Cape Addington	22 June	616
Forrester Island*	22 June	4,648
Biali Rock	22 June	794
Cape Cross	20 June	227
Assorted small sites		15
Subtotal		9,244
Total		47,960

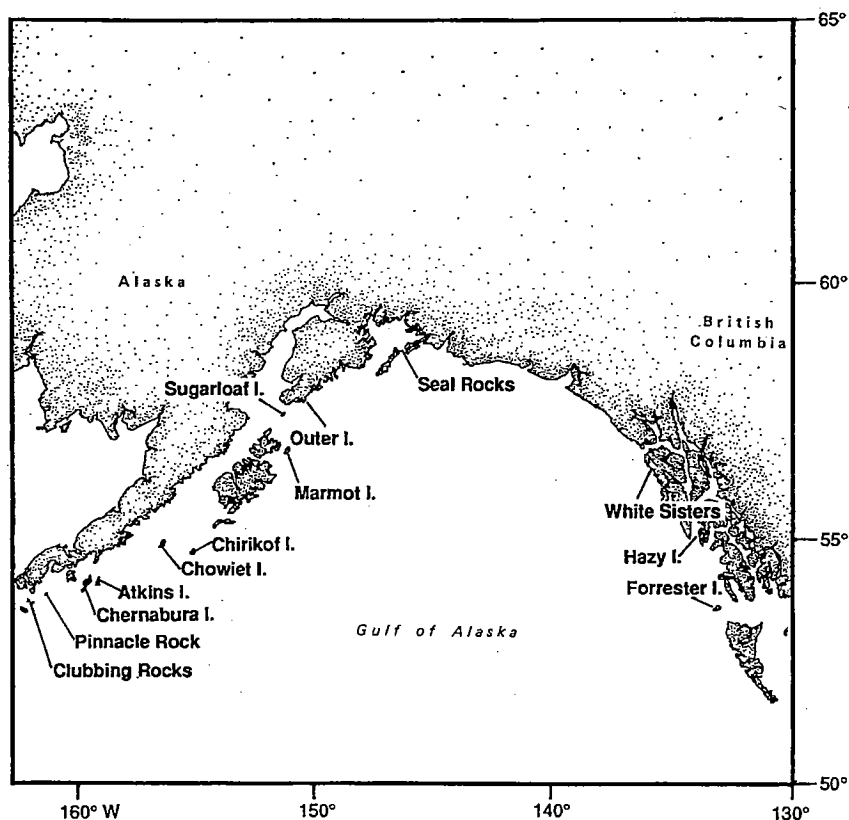


Figure 5. Map depicting Steller sea lion rookeries in the Gulf of Alaska and south-eastern Alaska.

nonpups and 600 pups (Robin Brown, Oregon Department of Fish and Wildlife, personal communication).

California—The number of Steller sea lions in California has declined from 6,000–7,000 in the 1960s to 2,500–3,000 in 1982, and to about 2,000 in 1989 (Robert Gisiner, Naval Ocean System Center, personal communication).

On 22 June, St. George Reef in northern California was surveyed by air and 415 individuals were counted, of which 23 were adult males and 11 were pups. The Farallon Islands were surveyed by land, resulting in a count of about 100 animals (Table 6), of which 42 were females and 3 were pups. The number of Steller sea lions at Año Nuevo Island has declined from 1,500 individuals in 1968 (Gentry 1970) to 422 individuals counted in 1990, of which 199 were females and 111 were pups. A 1989 count at Año Nuevo was incomplete. The other haul-out sites between St. George Reef and Año Nuevo Island (Sugarloaf Island and other sites) were surveyed in 1989 by small boat during seabird surveys from May through July; a total of 952 adults and juveniles was counted

Table 5. Steller sea lion haul-out sites on Washington's outer coast and estimates of peak numbers during August to March over past 15 years (from P. Gearin, personal communication).

Location	Latitude	Longitude	Count
Columbia River Buoy	46°N	124°W	50–60
Columbia River, south jetty	46°14'00"N	124°03'12"W	120–130
Rock 535, south of Split Rock	47°23'55"N	124°21'45"W	80–100
Split Rock	47°24'30"N	124°21'45"W	180–200
Carroll Island	48°00'20"N	124°43'20"W	120–150
Bodeltah Island	48°10'N	124°45'W	20–30
Rock NW Cape of Alava	48°10'55"N	124°44'30"W	120–130
Skagway Rocks	48°22'N	124°43'W	2–6
Tatoosh Island	48°23'30"N	124°44'30"W	30–40

(Table 6). These counts are considered minimum counts, and the actual total may have been higher. Steller sea lions no longer haul-out at San Miguel Island in the Channel Islands.

Canada

Rookeries occur at Danger Rocks, Cape Saint James, and the Scott Islands (Triangle, Sartine, Beresford, and Maggot Islands; Fig. 7); pups are no longer born at the Sea Otter Group (Virgin Rocks, Pearl Rocks, and Watch Rocks). An aerial survey of the Scott Islands on 20 July 1989 resulted in a count of 2,484 nonpups plus 751 pups (Table 7). Counts at each site include: Maggot Island, 343 nonpups and 162 pups; Beresford Island, 132 nonpups; Sartine

Table 6. Counts of adult and juvenile Steller sea lions at rookeries (*) and major haul-out sites (>75 sea lions counted in 1989) in Oregon and California during 1989 (from R. Brown, B. LeBoeuf, W. Sydeman, and H. Carter, personal communication).

Location	Date	Count
Oregon		
Three Arch Rocks*	22 June	243
Sea Lion Caves	22 June	375
Orford Reef*	22 June	446
Rogue Reef*	22 June	1,001
Other sites	22 June	196
Total		2,261
California		
St. George Reef*	22 June	404
Sugarloaf Island	27 May	282
Farallon Islands	July 1990	97
Other sites		670
Año Nuevo Island*	11 July 1990	311
Total		1,764

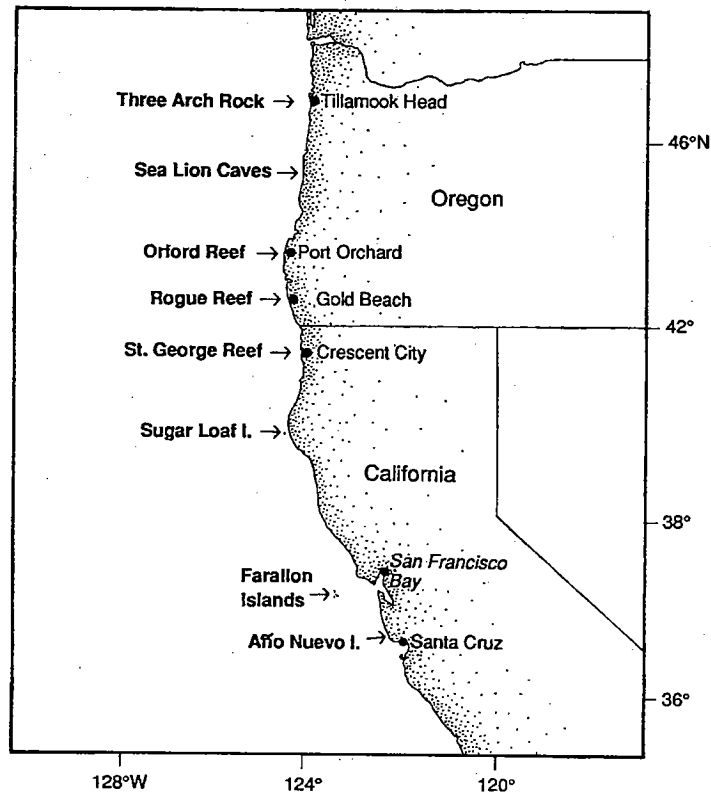


Figure 6. Map depicting Steller sea lion rookeries and haul-out sites in Oregon and California.

Island, 729 nonpups and 208 pups; and Triangle Island, 1,280 nonpups and 381 pups. A full survey of British Columbia was completed in 1987 (Table 7), and the sum total for adults and juveniles (6,109) obtained during that survey is used here.

The number of Steller sea lions in British Columbia was 11,000–14,000 sea lions in 1913 but was reduced by harvesting during 1913–1968 and has remained level at about 6,100 nonpups and about 1,050 pups since the 1970s (Bigg 1985).

Grand Total

Our 1989 count of adult and juvenile Steller sea lions throughout their range was 68,094 individuals. This total includes 10,000 in the Soviet Union (15% of the range-wide count), 47,960 in Alaska (70%), 6,109 in British Columbia (9%), 2,261 in Oregon (3%), and 1,764 in California (3%). About 11,000 pups were counted, but a range-wide pup count was not obtained.

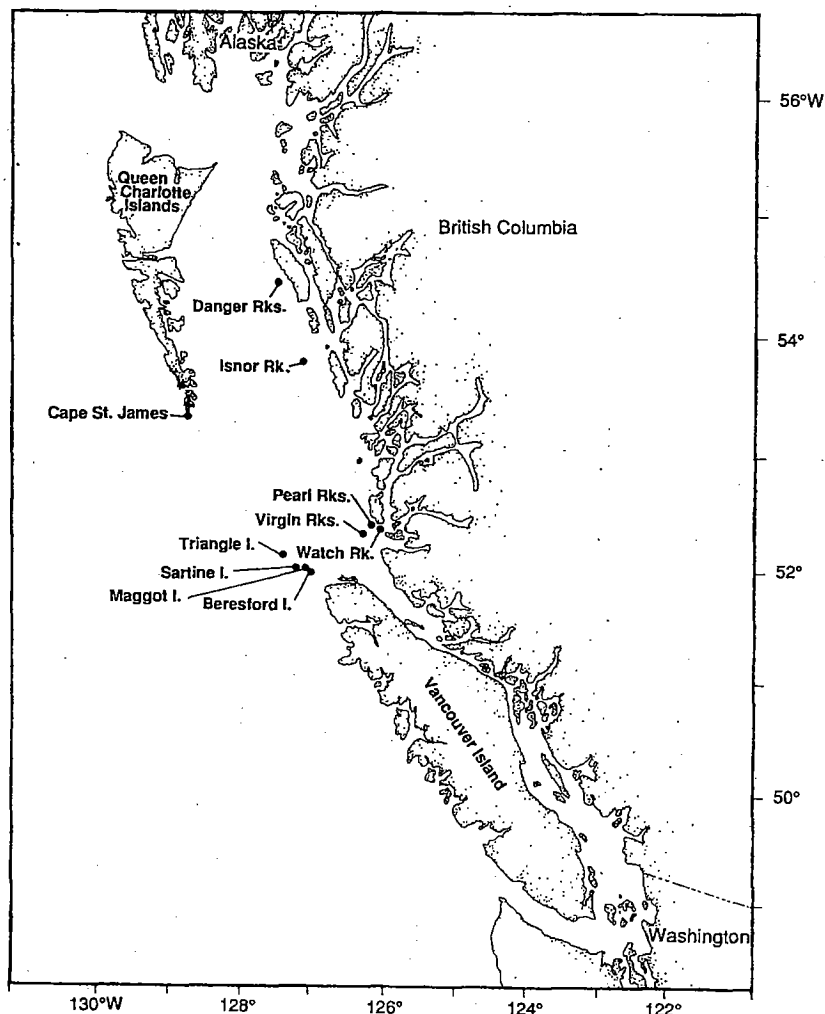


Figure 7. Map depicting Steller sea lion rookeries in British Columbia, Canada (modified from Bigg 1985).

DISCUSSION

Counts from the 1989 range-wide survey represent the minimum number of Steller sea lions on rookeries and haul-out sites during the optimal survey period. Some important rookery sites were missed (Column Rocks near Amchitka Island and Attu Island) or were not surveyed at the optimal time (Walrus Island, the Scott Islands in British Columbia, and Sugarloaf Island in California). While this resulted in a certain degree of underestimation, we believe that it did not significantly affect the total count.

Table 7. Counts of adult and juvenile Steller sea lions at rookeries (*) and haul-out sites in British Columbia during 29 June–3 July 1987 (full count) and 20 July 1989 (partial count). (From M. Bigg, P. Olesiuk, and G. Ellis, personal communication.)

Location	Year	Nonpups	Pups	Total
Carmanah Point	1987	146	0	146
Long Beach Rocks	1987	231	0	231
Barrier Rocks	1987	149	0	149
O'Leary Island	1987	60	0	60
Triangle Island*	1987	1,057	305	1,362
	1989	1,280	381	1,661
Sartine Island*	1987	600	176	776
	1989	729	208	937
Beresford Island*	1987	124	2	126
	1989	132	0	132
Maggot Island*	1987	550	178	728
	1989	343	162	505
Cape Scott	1987	1	0	1
Ashby Point	1987	210	0	210
Gosling Rocks	1987	135	0	135
Steele Rock	1987	7	0	7
Isnor Rock	1987	1	0	1
North Danger Rocks*	1987	339	54	393
Bonilla Island	1987	19	0	19
Reef Island	1987	482	0	482
Joseph Island	1987	309	0	309
Langara Island	1987	3	0	3
North Chads Point	1987	1	0	1
South Tasu Head	1987	263	1	264
Anthony Island	1987	44	1	45
Cape St. James*	1987	1,021	367	1,388
Pearl Rocks	1987	128	0	128
Virgin Rocks	1987	229	0	229
Total 1987 (full count)		6,109	1,084	7,193
Total 1989 (partial count)		2,484	751	3,235

An estimate of the actual population size is difficult to calculate. Survey data contain only the number of animals counted on land at the time of the surveys. An unknown number of animals are away from the rookery or haul-out site and are missed. We tried to calculate a correction factor to account for the amount of time the animals spent at sea during the census window by age, sex, and reproductive status, as well as the relative proportion of each segment in the population. Insufficient data were available to account for the missed animals based on time spent at sea.

Another estimation method, based on life table data in Calkins and Pitcher (1983), suggested that the total number of animals present at the end of the pupping season in the Gulf of Alaska should average four and one half times the number of pups born. A complete pup count was not obtained in 1989, but a survey of the area between Chirikof Island and Kiska Island in Alaska during 1990 provided both pup and nonpup counts (Merrick *et al.* 1991).

Table 8. Estimates of the number of nonpup Steller sea lions by year and geographical subarea. The percentage of each subarea to the world population and change in numbers from 1960 to 1989 are also shown.

Area	1960	% ^a	1977	%	1985	%	1989 ^b	%	Change ^c
Russia	52,000	21	29,000 ^d	15	18,000	13	13,310	15	-74%
Bering Sea (U.S.)	7,000	3	2,000	1	1,000	<1	887	<1	-87%
Aleutian Islands	99,000	40	90,000	46	61,000	45	19,033	22	-81%
Gulf of Alaska	69,000	27	55,000	28	38,000	28	31,600	34	-54%
Southeastern Alaska	7,000	3	8,000	4	8,000	6	12,303	14	+70%
British Columbia	8,000	3	5,000	3	5,000	4	8,131	9	00%
Oregon and California	8,000	3	5,000	3	4,000	3	5,357	6	-33%
Total	250,000		194,000		135,000		90,621		-64%

^a Percentage of the total for that year.

^b The counts obtained in 1989 multiplied by 1.331 (pup-correction method) except for British Columbia for which 1987 was used.

^c Percentage change from 1960 to 1989.

^d 1977 and 1985 values for Russia were calculated assuming the population declined by a constant number of animals each year 1960-1989. Actual values were not available.

During that survey, 6,871 pups and 18,066 nonpups were counted, totaling 24,937 individuals. Using the Calkins and Pitcher (1983) correction factor of four and one half times the pup count ($4.5 \times 6,871$), the sea lion population from Chirikof Island to Kiska Island in 1990 should have totaled 30,919 individuals (pups and nonpups). Subtracting the counted pups from the estimated grand total results in 24,048 estimated nonpups compared with 18,066 counted nonpups. The resulting nonpup correction factor is 1.331 ($24,048 \div 18,066$); a pup estimate can be obtained by dividing the total counted nonpups by 2.63.

Using this procedure, and assuming that other geographic areas have the same proportion of pups to nonpups and that the population had not changed significantly between 1989 and 1990 (Merrick *et al.* 1991), the estimated world population in 1989 would be 68,094 (the number of nonpups counted on land) $\times 1.331 = 90,633$ nonpups (Table 8); 68,094 divided by 2.63 = 25,891 pups. The pup estimate seems reasonable when compared with the partial pup counts in 1989 and 1990 of about 16,000 pups (Merrick *et al.* 1990, 1991). When the pup estimate is added to the nonpup estimate, the range-wide estimate of Steller sea lions during the 1989 breeding season is 116,000 (116,524) individuals. This estimate is about 39–48% of the 240,000–300,000 pups and nonpups estimated 30 yr ago (Kenyon and Rice 1961).

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